

Claims

1. A filter which has at least two filter elements having a substrate comprising a cylindrical porous body having many pores and having a plurality of cells as flow paths for untreated liquid and a filtering membrane comprising a porous body smaller in average pore diameter than that of the substrate and formed on the inner wall of a plurality of the cells, and said at least two filter elements are contained in a casing, wherein said at least two filter elements contained in the casing are connected in series in such a state as interposing a first sealer between them, and the first sealer separates liquid-tightly a plurality of the cells from a space formed between the outer peripheral surface of said at least two filter elements and the inner peripheral surface of the casing and does not hinder a plurality of the cells of said at least two filter elements from communicating with each other.

2. A filter according to claim 1, wherein the substrate and filtering membrane constituting the filter elements comprise a ceramic.

3. A filter according to claim 1 or 2, wherein the first sealer is a seal cap.

4. A filter according to any one of claims 1-3, wherein said at least two filter elements are connected in series in such a state as providing a supporting plate between them, the first sealer is interposed between said at least two filter elements and the supporting plate, and the supporting plate has a first opening which allows a plurality of the cells of said

at least two filter elements to communicate with each other and a second opening which allows the spaces formed between the outer peripheral surface of said at least two filter elements and the inner peripheral surface of the casing to communicate
5 with each other.

5. A filter according to claim 4, wherein the casing comprises at least two hollow cylindrical cases having a flange at the end part, said at least two hollow cylindrical cases are connected in series in such a state as providing the supporting
10 plate between the flanges, a second sealer is interposed between the flange and the supporting plate, the second sealer liquid-tightly separates a space formed between the outer peripheral surface of said at least two filter elements and the inner peripheral surface of the hollow cylindrical case from
15 the external space of the hollow cylindrical case and does not hinder the spaces formed between the outer peripheral surface of said at least two filter elements and the inner peripheral surface of the hollow cylindrical case from communicating with each other.

20 6. A filter module in which a filter element having a substrate comprising a cylindrical porous body having many pores and having a plurality of cells as flow paths for untreated liquid and a filtering membrane comprising a porous body smaller in average pore diameter than that of the substrate and formed
25 on the inner wall of a plurality of the cells is contained in a hollow cylindrical case having flanges at both end parts, wherein the filter element is contained in the hollow cylindrical case in such a state as both end faces being

supported by a supporting plate and a first sealer is interposed between the filter element and the supporting plate; the supporting plate has a first opening communicating with a plurality of the cells of the filter element and a second opening communicating with a space formed between the outer peripheral surface of the filter element and the inner peripheral surface of the hollow cylindrical case; and the first sealer liquid-tightly separates a plurality of the cells from the space formed between the outer peripheral surface of the filter element and the inner peripheral surface of the hollow cylindrical case and does not hinder a plurality of the cells of the filter element and the first opening from communicating with each other.

7. A filter module according to claim 6, wherein the substrate and filtering membrane constituting the filter element comprise a ceramic.

8. A filter module according to claim 6 or 7, wherein the first sealer is a seal cap.

9. A filter module according to any one of claims 6-8, wherein a second sealer is interposed between both the flanges of the hollow cylindrical case and the supporting plate, and the second sealer liquid-tightly separates a space formed between the outer peripheral surface of the filter element and the inner peripheral surface of the hollow cylindrical case from the external space of the hollow cylindrical case and does not hinder the second opening of the supporting plate and the space formed between the outer peripheral surface of the filter element and the inner peripheral surface of the hollow

cylindrical case from communicating with each other.

10. A filter module according to claim 9, wherein the supporting plate and the flanges of the hollow cylindrical case have a bolt hole into which a bolt for bonding the supporting
5 plate and the flange can be screwed, and a dent in which the head of the bolt can be put is formed at the bolt hole of the supporting plate.

11. A filter having at least two filter modules of any one of claims 6-10 which are connected in series, wherein said
10 at least two filter modules are connected in series in such a state as interposing a third sealer and a fourth sealer between them, the third sealer liquid-tightly separates the first opening from the second opening of the supporting plate constituting said at least two filter modules and does not
15 hinder the first openings of said at least two filter modules from communicating with each other, and the fourth sealer liquid-tightly separates the second opening of the supporting plate constituting said at least two filter modules from the external space of the filter modules and does not hinder the
20 second openings of said at least two filter modules from communicating with each other.

12. A filter according to claim 11, wherein a purified liquid recovery port is provided at only the filter module connected at the uppermost part of the filter among said at least
25 two filter modules connected in series.